Amendments to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

1-21. (Canceled)

22. (Currently Amended) A process for producing at least one ~~carbon-based structure selected from nanotubes, nanofibers and nanostructures~~ carbon nanostructure according to claim 32, comprising the steps of:

a) generating a plasma with electrical energy;

b) introducing a carbon precursor and optionally one or more catalysts and optionally a carrier plasma gas in a reaction zone of a high temperature resistant vessel;

c) vaporizing the carbon precursor in the reaction zone at a very high temperature forming a vaporized carbon precursor;

d) guiding at least a fraction of the vaporized carbon precursor through an opening in a nozzle having an inlet and an outlet wherein the opening narrows toward the outlet;

e) guiding at least a fraction of the vaporized carbon precursor into a quenching zone for nucleation wherein the quenching zone has an upper part and a lower part;

f) generating flow conditions by aerodynamic or electromagnetic forces to reduce flow of the carbon precursor, the vaporized carbon precursor, the one or

more catalysts, and the carrier plasma gas from the quenching zone to the reaction zone;

g) controlling the temperature of the upper part of the quenching zone at the very high temperature and the lower part of the quenching zone at a lower temperature to provide a quenching velocity between 10^3 K/s and 10^6 K/s;

h) quenching the fraction of vaporized carbon precursor guided into the quenching zone;

i) extracting at least one ~~carbon-based structure from the quenching zone where the at least one carbon-based structure is selected from nanotubes, nanofibers, and nanostructures~~ carbon nanostructure; and

j) separating the at least one ~~carbon-based structure~~ carbon nanostructure from at least one other reaction product.

23. (Previously Presented) The process of claim 22, wherein the step of generating the plasma with electrical energy comprises directing a carrier plasma gas through an electric arc formed between two or more electrodes.

24. (Currently Amended) The process of claim 22, wherein at least one characteristic of the process is chosen from;

a) the plasma is generated by electrodes consisting of graphite,

b) the carrier plasma gas is directed through an electric arc formed between two or more electrodes connected to an AC power source optionally having a current frequency between 50 Hz and 10 kHZ,

c) the reaction zone is subjected to an absolute pressure between 0.1 bar and 30 bar,

d) the opening in the nozzle has a surface consisting of graphite;

e) the nozzle comprises a continuous or stepped cone;

f) the opening in the nozzle abruptly expands toward the outlet;

g) the carbon precursor is a solid carbon material;

h) the carbon precursor is a hydrocarbon;

i) the catalyst is a solid catalyst;

j) the catalyst is a liquid catalyst;

k) the catalyst is one or more of Ni, Co, Y, La, Gd, B, Fe, and Cu in solid form, in liquid suspension or as an organometallic compound;

l) the catalyst is added to the carbon precursor;

m) the catalyst is added to the carrier gas;

n) the carrier plasma gas includes one or more of hydrogen, nitrogen, argon, carbon monoxide, helium or other gas without carbon affinity;

o) the carrier plasma gas is used to carry one or more of the carbon precursor and the catalyst;

p) a quenching gas is provided to the quenching zone wherein the quenching gas is chosen from hydrogen, nitrogen, argon, carbon monoxide, helium or other gas without carbon affinity;

q) the step of extracting the at least one ~~carbon-based structure~~ carbon nanostructure from the quenching zone comprises introducing an extracting gas

to the quenching zone wherein the extracting gas is chosen from hydrogen, nitrogen, argon, carbon monoxide, helium or other gas without carbon affinity;

r) the gas temperature in the reaction zone is higher than 4000°C;

s) the gas temperature in the quenching zone is between 4000°C in the upper part of this zone and 50°C in the lower part of this zone;

t) the flow of carrier plasma gas is adjusted, depending on the nature of the quenching gas, to provide between 0.001 Nm3/h to 0.3 Nm3/h per kW of electric power used in the plasma arc;

u) the quenching gas flow rate is adjusted, depending on the nature of the quenching gas, between 1 Nm3/h and 10 000 Nm3/h;

v) a portion of an off-gas from a reaction that produces at least one of the carbon-based structures is recycled as at least a portion of the gas for generating the plasma;

w) a portion of the off-gas from the reaction is recycled as at least a portion of the quenching gas;

x) the carbon precursor is introduced to the reaction zone by injecting the carbon precursor through at least one injector and optionally through two to five injectors;

y) the carbon precursor is injected into the reaction zone;

z) the carbon precursor is injected into the reaction zone with a flow component chosen from tangential, radial and axial;

aa) the process is carried out in an environment chosen from an environment with an absence of oxygen, an environment with a small quantity of oxygen, and an environment with an atomic ratio oxygen/carbon of less than 1/1000;

bb) the plasma gas is carbon monoxide and the process is carried out in the presence of oxygen with a maximum atomic ratio oxygen/carbon of less than 1001/1000 in the plasma gas;

cc) the process results in recovery of a product chosen from carbon black, fullerenes, single wall nanotubes, multi-wall nanotubes, carbon fibers, carbon nanostructures, and catalyst.

25. (Currently Amended) A reactor for performing the process according to claim 22, comprising: ~~producing carbon-based nanotubes, nanofibers and nanostructures comprising~~:

a) a head section comprising at least two electrodes; and

optionally comprising at least one supply chosen from a carbon precursor supply, a catalyst supply, and a gas supply;

b) a reaction zone characterized by having at least some gas temperatures during operation of 4000°C or higher;

c) at least one injector for injecting into the reaction zone an injected material chosen from a carbon precursor and a catalyst,

d) a quenching zone where the gas temperature is controllable between 4000°C in the upper part of this zone and 50°C in the lower part of this zone, wherein the quenching zone is in fluid communication with the reaction zone; and

e) a nozzle shaped choke, narrowing the open flow communication between the reaction zone and the quenching zone, wherein the nozzle shaped choke comprises a nozzle having an opening.

26. (Previously Presented) The reactor of claim 25, wherein the reactor is characterized by having a substantially cylindrically shaped interior.

27. (Previously Presented) The reactor of claim 25, comprising a chamber with a height between 0.5 and 5 m and a diameter between 5 and 150 cm.

28. (Previously Presented) The reactor of claim 25, wherein surfaces subject to high temperature during operation of the reactor comprise graphite and optionally additional high temperature resistant material.

29. (Previously Presented) The reactor of claim 28, further comprising a chamber with a height between 0.5 and 5 m and a diameter between 5 and 150 cm.

30. (Previously Presented) The reactor of claim 25, further comprising a temperature control means for the quenching zone chosen from thermal insulating lining, fluid flow, indirect heat exchange means, flow controlled quench gas injection means, and temperature controlled quench gas injection means.

31. (Previously Presented) The reactor of claim 25, wherein the nozzle shaped choke is a tapering choke followed by an abruptly expanding section.

32. (Previously Presented) A carbon nanostructure comprising:
a linear chain structure characterized by connected, substantially identical beads, wherein the beads are selected from spheres, bulb-like units and trumpet shaped units.

33. (Previously Presented) The carbon nanostructure of claim 32, wherein the diameter of the spheres of the spherical section of the bulb-like units or respectively the large diameter of the trumpet shaped section are between 100 to 200 nanometers.

34. (Previously Presented) The carbon nanostructure of claim 33, wherein the diameter of the spheres or bulb-units are similar.

35. (Previously Presented) The carbon nanostructures of claim 32, comprising:

periodic graphitic nano-fibers characterized by a repetition of multi-wall carbon spheres connected along one direction wherein at least two or more of the multi-wall carbon spheres contain a metal particle.

36. (Previously Presented) The carbon nanostructures of claim 32, wherein at least 5 beads are connected in one chain.

37. (Previously Presented) The carbon nanostructures of claim 36, wherein 20 to 50 beads are connected in one chain.

38. (Previously Presented) The carbon nanostructures of claim 32, wherein one or more of the beads further comprises a catalyst.

39. (Previously Presented) The carbon nanostructures of claim 38, wherein the catalyst comprises a ferromagnetic metal catalyst.

40. (Previously Presented) The carbon nanostructures of claim 39, wherein the ferromagnetic metal catalyst comprises a metal atom chosen from nickel and cobalt.

41. (Previously Presented) The carbon nanostructures of claim 32, wherein the beads are bulb-like units or bell-like units connected to each other by external graphitic cylindrical layers.

42-46. (Canceled)

47. (Currently Amended) A carbon nanostructure according to claim 32, comprising:

a shape substantially similar to a nanostructure shape shown in one or more of Figures 4-9.

48. (Currently Amended) A composite comprising:

a) a polymer matrix; and

b) carbon nanostructures according to claim 32. ~~having a linear chain structure characterized by connected, substantially identical beads, wherein the beads are selected from spheres, bulb-like units or trumpet shaped units.~~

49. (Previously Presented) The composite of claim 48, wherein the polymer is selected from the group consisting of polyethylene, polypropylene, polyamide, polycarbonate, polyphenylenesulfide, and polyester.